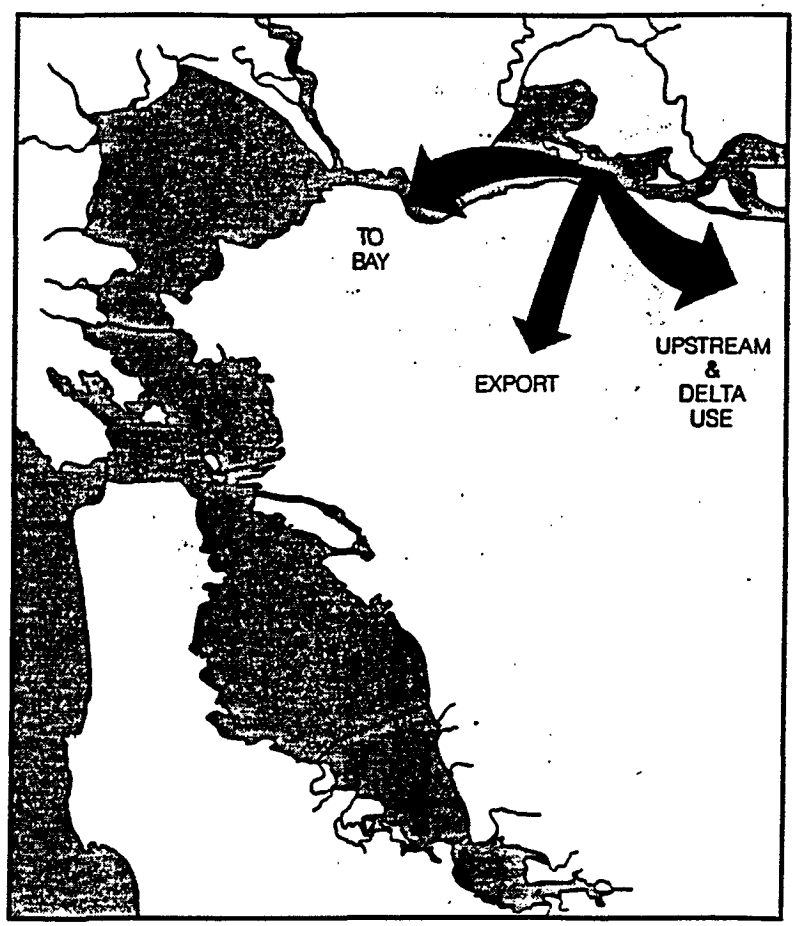
Appendix 4

ANALYSIS OF THE INFLUENCE OF WATER WITHDRAWALS ON RUNOFF TO THE DELTA-SAN FRANCISCO BAY ECOSYSTEM (1921-83)



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wet
Annual, subnormal,
dry and critical
dry

Summary.

Gradual substantial annual increases of upstream, downstream and total diversions during post-project period (1944-1983) in comparison with the pre-project period (1921-43) have resulted in significant modification of the Sacramento-San Joaquin river water supply to the Delta-Bay estuarine system:

1. The number of subnormal, dry and critical dry years of RRI and RDO increased 1.3-2 times, while the number of wet and normal years in comparison with NRI and NDO decreased by half.

2. As a result, the San Francisco Bay ecosystem has experienced a chronic deficit in water supply, particularly for years of normal and subnormal and critical natural water supply.

3. The predominant range of annual upstream Delta and total water diversion since the 1960's (up to 1983) was 20-30%, 20-45% and 35-52%, respectively.

4. The predominant range of absolute values of upstream, Delta and total diversions was 6-12, 4-6 and 9-13 MAF, respectively.

5. As a general rule, the highest percentage of diversions before and after CVP and SWP completion occurred in years of subnormal and critical dry categories of wetness.

6. The highest volume water was diverted in wet and normal years following years of subnormal or low wetness.

7. In general, the persistent increases in annual upstream, downstream and total water diversions from the Sacramento-San Joaquin river system (which are many times higher, that those documented for the pre-project period) support the assumption that the entitlement of different water users has been the factor governing the management of this system. It is our contention

that in order to maintain the health of the Delta-Bay system, decisions regarding water diversions should be based on the natural limits of the water resources and wetness of the year (for a series of years) based upon data on past and present flow regimes.

Table II. 3 The number of years of different wetness in relation to "normal" runoff - Annual

Runoff Characteristics	Wettest and Wet Years	Years	Sub-normal and Dry Years	Years	Critical Dry Years	Years
Qnri	1921, 1927, 1938, 1940-43, 1951, 1952, 1956, 1958, 1963, 1965, 1967, 1969-70, 1974, 1978, 1982	18	1925, 1930, 1944, 1947, 1949, 1955, 1959, 1961, 1964, 1968, 1972	11	1924, 1929, 1931, 1933, 1934, 1939, 1976, 1977	8
Qrri	1938, 1941-42, 1952, 1956, 1958, 1969, 1974, 1982	9	1926, 1930, 1932, 1945, 1948, 1949, 1950, 1954, 1957, 1959, 1962, 1966, 1968, 1979	14	1924, 1929, 1931, 1933, 1934, 1939, 1944, 1947, 1955, 1960, 1961, 1964, 1972, 1976, 1977, 1981	16
Qndo	1921, 1927 1938, 1941-43 1951, 1952, 1956, 1958, 1963, 1965, 1967, 1969-70, 1974, 1978, 1982	18	1926, 1930, 1944, 1947, 1949, 1955, 1959-61, 1964, 1968, 1972	11	1924, 1929, 1931, 1933 1934, 1939 1976, 1977	8
Qrdo	1938, 1941, 1942, 1952, 1956, 1958, 1969, 1974 1982	9	1923, 1926, 1930, 1932, 1945, 1948, 1950, 1954, 1957, 1962, 1975	11	1924, 1929, 1931, 1933, 1934, 1939, 1944, 1947, 1949, 1955, 1959, 1960, 1961, 1964, 1966, 1968, 1972, 1976, 1977, 1979, 1981	21

Note: 1. Wettest and wet years - the Qnri and Qrri and Qndo and Qrdo of any year are 25% or more above "normal" (28.3 and 27.2 MAF, respectively)

2. Sub-normal and dry years of wetness - when the same runoff parameters are 25% or more below "normal."

3. Critical dry years of wetness - when the Qnri, Qrri, Qndo and Qrdo are 50% or more below "normal."

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